



Office of Science and Technology



ENVIRONMENTAL FUTURES

Foresight

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Foresight

The UK's national Foresight Programme is a major initiative that sets out to identify opportunities to create sustained competitive advantage and to enhance the quality of life. Foresight is managed by the Office of Science and Technology, a part of the Department of Trade and Industry.

Since it began in 1993, the national Foresight Programme has drawn on the expertise of thousands of people, from many of the country's leading companies, universities, government and other institutions.

By identifying technical opportunities and social drivers, Foresight has helped to shape research priorities, both in the public and private sectors.

The next round of Foresight, beginning in April 1999, will build on what has been achieved so far.

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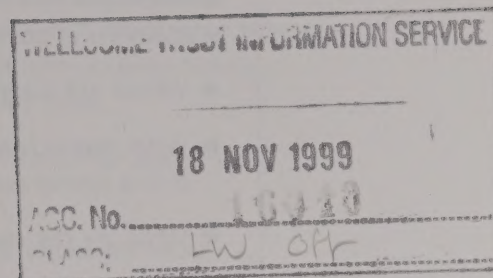
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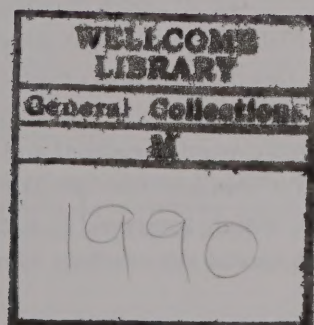
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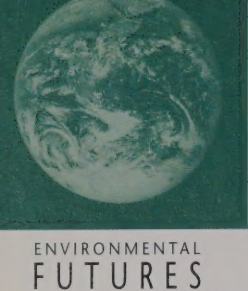
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INTRODUCTION

This report contains four futures scenarios, which have been developed with the aim of stimulating debate about the future.

Foresight is a way of thinking about the future, of identifying opportunities in technologies and markets that could arise over the next 20 years. It brings business, academia and government together to answer questions such as:

- Where will future market opportunities lie?
- What research and action needs to take place now to ensure that UK business is in a strong position to make the most of these future opportunities?
- What are the social and quality of life implications of this?

Consideration of futures scenarios is central to Foresight. They provide the context for thinking about how the future could look, and are a stimulus for wide-ranging debate that leads companies and organisations to think about and develop strategies for the future. For example the following scenarios are already being used in the Transport Panel in the Foresight Programme, in able to to test the robustness of integrated transport schemes.

THE FUTURES SCENARIOS

The scenarios are not intended to predict the future; rather, they aim to highlight current choices, given possible futures.

The four futures scenarios set out in this report describe the United Kingdom, during the period 2010-2040. The scenarios suggest *possible* futures, exploring alternative directions in which social, economic, and technological changes may evolve over coming decades. Specifically, they have been developed to cast light on *environmental* futures, but the scenario framework is relevant to all sectors, and can be used and developed further by those who live, work and do business in the UK and globally to produce a larger set of indicators, with direct relevance to other sectors.

The scenarios have been framed in the context of two basic dimensions of change: social values and governance systems. These dimensions are taken as axes which define the four scenarios (figure 1). The *social values* dimension takes account of policy-making priorities and patterns of economic activity, including consumption behaviour. At one end of the spectrum (CONSUMERISM), values are dominated by individualism, private consumption and short-term considerations. At the other end (COMMUNITY) there is a greater concern with long-term social goals such as sustainable economic development, social cohesion and equality.

The *governance system* dimension represents the structure of political authority and decision-making. At one end (GLOBALISATION), governance is increasingly distributed away from the national level; this is seen as occurring both upwards - to country blocks such as the European Union and global organisations, for example the World Trade Organisation - and downwards towards devolved and regional governments in the UK. At the other end of the spectrum (REGIONALISATION), national sovereignty in decision-making is largely preserved or even strengthened. The four main scenarios and numerous potential intermediate forms fit within this framework, as the figure shows.



The scenarios outlined in this report are intended to show how the scenario framework can be used. They are intended to be neither exhaustive nor definitive. They consist mainly of a 'storyline' but include some quantitative indicators which illustrate the direction and rate of certain changes. Each scenario contains an overview of its broad characteristics, with more detail given on economic activity, population and settlement, implications for different sectors (energy, transport, construction, agriculture and food, manufacturing) and the state of the environment. A synopsis of the main characteristics of each of the four scenarios is given below. Some of the key indicators for each are shown in the summary table.

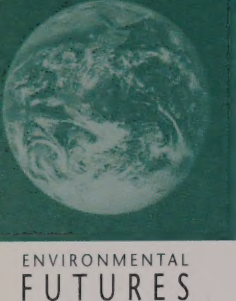
World Markets: a world defined by emphasis on private consumption and a highly developed and integrated world trading system.

Global Sustainability: a world in which social and ecological values are more pronounced and in which the greater effectiveness of global institutions is manifested through stronger collective action in dealing with environmental problems.

Summary of scenario characteristics

	WORLD MARKETS	PROVINCIAL ENTERPRISE	GLOBAL SUSTAINABILITY	LOCAL STEWARDSHIP
VALUES	Consumerist	Individualist	Conservationist	Conservative
GOVERNANCE	Globalised	National	Globalised	Regional/National
UK GDP (per year)	3%	1.5%	2%	1%
FAST GROWING SECTORS	health care, leisure, distribution, financial services	private health care and education, maintenance services, defence	renewable energy, household services, information- intensive business services, nuclear power	small-scale, intensive manufacturing, locally-based financial and other services, small-scale agriculture
DECLINING SECTORS	manufacturing, agriculture	high-tech specialised services, financial services	fossil fuel-based power systems, resource-intensive agriculture and manufacturing	retailing, leisure and tourism
EQUITY	Declines	Declines	Improves	Improves
ISEW (per year) ¹	-2%	-4%	+2%	+1%
ENVIRONMENTAL STATE				
Air quality	General decline	Declines	Improvement	Mixed
Water quality	Mixed	Deteriorates	Improvement	General improvement
Biodiversity	Under pressure	Deterioration	Stable	Improves
Climate	Emissions trading	Management fails	Strong climate management	Weak management

¹ Index of Sustainable Economic Welfare. The ISEW adjusts GDP per capita income to take account of: spending to offset social and environmental costs; long-term environmental damage; the distribution of incomes; and the value of household labour.



Provincial Enterprise: a world of private consumption values coupled with a capacity for lower level policy-making systems to assert local, regional and national concerns and priorities.

Local Stewardship: a world where stronger local and regional governments allow social and ecological values to be demonstrated to a greater degree at local level.

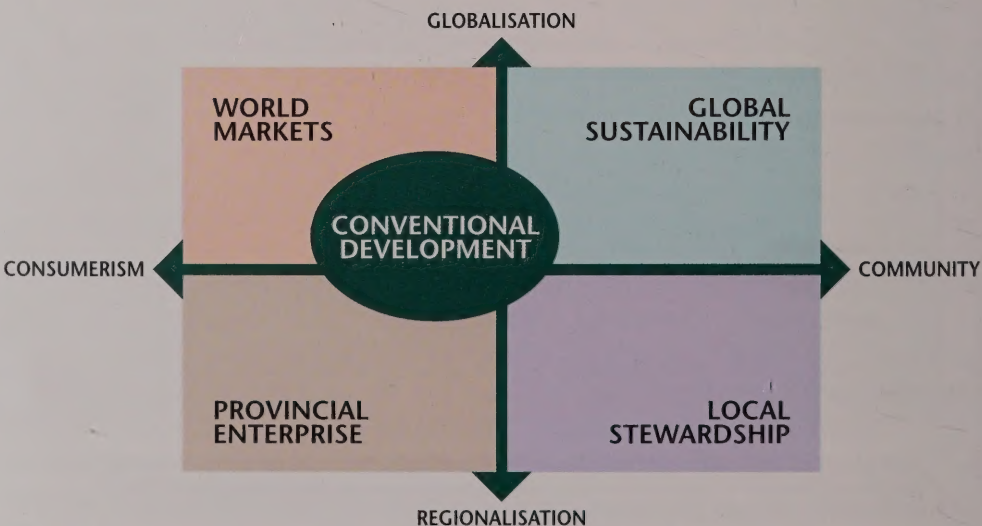
USING THE SCENARIOS

The futures scenarios are intended to stimulate debate about possible futures and encourage action today.

The scenarios form a starting point for thought and discussion about the major trends and influences that could have an impact on the markets in which companies operate to sell their goods and supply their services. This discussion can help guide current decision-making at a strategic level. The Foresight Process Guide (Future Markets, Future Business), available from the Office of Science & Technology, describes how to organise such an exercise. This could take the form of a workshop or seminar, within an individual company or involving many organisations. Material on future market opportunities is also available, for example in the report ‘Sustainable Technologies for a Cleaner World – a key priority and major opportunity’ which highlights research areas and potential markets for technologies, techniques and services in some ten different sectors of the economy.

The scenarios have been developed to be relevant to a range of audiences - business, researchers, regulators, government, and other organisations. Users are encouraged to engage the scenarios to develop their own conclusions about the future, and take the framework described in the previous section as a building block to develop scenarios more specific to their own needs (the scenario elaborations which follow give some initial ideas). Benefits should be gained from attempting to utilise the full range of scenarios included in this report, as this provides the widest set of opportunities and challenges.

Figure1: Four contextual UK futures scenarios





SCENARIO 1: WORLD MARKETS

BASIS

This scenario is based on the assumed prevalence of short-term consumerist values together with globalisation of governance systems. Social values are materialist, with resulting high levels of consumption and mobility. Working towards long-term sustainable development is marginalised as a political goal. There is a declining role for governments in economic management and in the provision of healthcare, education and other social services. Pressure grows to reduce taxes. Privatisation of public services leads to increasing inequalities in access and quality of health, education and social services. There is very light regulation of utility markets (energy, water, telecommunications), even where there is a high degree of market concentration. There is minimal concern over inequity or social exclusion, and social tensions rise. The affluent retreat into secure managed (and virtual) environments and there is increased demand for private security services.

Political values are internationalist. Economic, fiscal, trade and defence policies are transferred increasingly from the national to the EU level. Some EU competencies (such as on the environment) are passed on to global institutions. There is strong growth in international trade promoted by an effective World Trade Organisation. There is some move towards more federal political structures within states, but these remain weak compared to European and global institutions. In general, there is a convergence of political cultures across Europe and the industrialised world.

**'WORLD MARKETS': KEY INDICATORS**

Values: emphasis on short-term welfare and meeting personal demand

Governance: strong global institutions, especially those promoting and governing trade

UK GDP growth: 3% per year, with widening income distributions

Fast-growing sectors: private healthcare/education provision; leisure and entertainment; distribution and transportation; financial services

Declining sectors: traditional manufacturing; agriculture

Key technologies: biotechnology applied to agriculture and healthcare; information and communication technologies applied to transport, work and the household

Settlement and Population: suburbanisation and increased settlement in the countryside; development in coastal zones; growth of 'private communities'; substitution of artificial/virtual for natural environmental quality

Environmental issues and priorities: emphasis on local/neighbourhood issues such as clean air and built environment, especially in wealthier areas; access to nature parks regulated by access pricing; biodiversity pressures; unambitious international climate regime

ECONOMIC ACTIVITY

This is a high-growth world. Primacy is given to the expansion of liberalised, open markets. Long-term growth of gross world product (GWP) is 5 per cent per year, while UK GDP growth reaches 3 per cent. Globalisation leads to greater integration and further growth of financial markets. Single currency zones emerge around the world (e.g. the UK joins EMU in 2003). Global markets are dominated by large transnational firms. High concentration into a few global players occurs in key industries (telecommunications, integrated utilities, aerospace and automobiles) while there is high specialisation for smaller niche producers in other sectors, also operating in global markets. Services come to dominate economic activity. Rapid growth in developing countries accelerates the decline of traditional manufacturing in the UK, but creates international opportunities for capital goods and project engineering services. International best practice in technology and management is adopted quickly and global standards emerge for many products and services.

POPULATION AND SETTLEMENT

The UK population grows slowly, but the labour force becomes increasingly mobile, with an increasingly global labour market. There is a higher rate of immigration from outside Europe, especially into low-paying service employment. Planning controls are relaxed, and the distinction between the country and the city blurs, especially in the south-east. There will be heavy new investment in infrastructure, including those of transport and water transfer. Segregation between the wealthy and the disadvantaged becomes more marked and 'gated communities' develop. The trend towards smaller household units will continue.



SECTORAL/TECHNOLOGY DEVELOPMENTS

Energy

Energy markets are dominated by fossil fuels, particularly natural gas. By 2020 exploitation of alternatives to conventional oil, including tar sands, begins. High discount rates and the low priority attached to global environmental problems preclude the widespread adoption of renewable energy or nuclear power. Demand for electricity and transportation fuels continues to grow. Electricity supply investments are generally in modular, distributed power systems. Energy prices remain low, and there is little concern for energy efficiency.

Transport

Rapid growth of car use continues. The internal combustion engine will predominate but hybrids and electric vehicles will be used in major metropolitan areas from 2010 onwards. Congestion will increase, partially relieved by the greater use of infomatics. By 2020 access to some major roads will be restricted to cars with autopilot, anti-collision and routing functions. The high demand for mobility and global tourism, and globalised markets for goods, will lead to continued growth in air traffic, both internationally and within the UK. Greater use will also be made of inter-city rail, whose economics will be driven by the needs of business passengers.

Construction

The construction industry experiences high rates of growth and there is rapid innovation in technologies for the built environment. Lower priority is attached to the preservation of existing buildings. The planning system is weak, and new towns and communities are constructed on greenfield sites. New technologies, materials and construction processes are adopted and there are major advances in training and skills. The scale of the built environment increases with city centres, campuses and tourist villages being given covered and conditioned environments.

Agriculture and Food

Agriculture becomes increasingly concentrated, industrialised and global in scale. Farms increase in size, accelerating the adoption of technological approaches such as 'precision farming'. The Common Agricultural Policy is abandoned, and lower food prices prompt farmers to search for improved productivity. The use of genetically modified crops becomes pervasive. There is a growing differentiation between staple 'engineered' foods, and higher value unadulterated food produced using traditional methods. For the majority, diets improve, although there are growing problems of obesity and diet-related illness amongst the less well-off.

Manufacturing

There are generally high rates of innovation and growth in many manufacturing sectors, with IT and biotechnology being the main technological drivers of change. Traditional manufacturing in primary industries declines as a result of competition from newly industrialising countries. The scale of commodity production continues to grow. Assembly industries linked to complex, global, supply chains are generally small-scale and agile. Local and regional specialisation is significant in high value-added industries.



THE STATE OF THE ENVIRONMENT

Environmental improvement is not a priority in this scenario except where wealthy people are effective in asserting their local demands for clean air, attractive surroundings and reduced noise levels.

Air quality: Small initial gains from the continued dash for gas. Incremental improvements in vehicle technology are eventually outweighed as a result of increasing traffic volumes.

Noise: Overall deterioration due to increased traffic levels and leisure activities, except in wealthier areas where access is controlled. Aircraft noise increases significantly.

Water resources: Demand increases and is met through new sources of supply.

Water quality: Mixed picture, improvement in recreational areas.

Biodiversity: Under pressure due to agricultural practices and the low priority attached to habitat preservation.

Landscape: Patchy impact, encroachment of towns on the countryside, but also protection of landscapes for wealthier tourists and retirees.

Materials and resources use: 'Win-win' efficiency opportunities taken up; continuing improvement through technical change in some industrial sectors. Household waste volumes increase but waste becomes a commodity which is increasingly cycled through in energy-from-waste incinerators.

Climate: The international climate regime moves on under its own momentum and more, but rather weak, agreements are struck. Emissions trading plays a major role in implementation. The UK becomes increasingly vulnerable to climate change.



SCENARIO 2:

PROVINCIAL ENTERPRISE

BASIS

This scenario assumes individualistic consumerist values and the reinforcement of governance systems at the national and sub-national levels. Sustainability more or less disappears as a political objective. The dominant political values are conservative and inward-looking. Independence in economic and foreign policy is preserved, while the UK's relationship with Europe remains arms-length. The UK does not join the EMU, and the single currency in Europe is generally unsuccessful due to a failure to coordinate economic policy in the EU. Globalising forces operating in the economic, political and cultural domains are constrained.

Market values are dominant, but the scope of markets is limited by national and provincial boundaries. Economic growth is slow. There is an uneasy balance between the espousal of market values, and the pursuit of national and local interests. International trade in goods and services grows relatively slowly. Economic protection and the defence of national sovereignty require a 'strong centre', whether in London, Edinburgh or Cardiff. The symbolic role of the state remains strong but its capacity to manage the economy effectively declines. Economic and political power is consolidated in strong interest groups (the defence establishment, the professions and manufacturing industry). There is little commitment to social or environmental goals, and an 'enterprise' ideology informs most policy decisions.



PROVINCIAL ENTERPRISE: KEY INDICATORS

Values: emphasis on the short-term and meeting personal demand

Governance: national and regional institutions are successful in asserting their own interests

UK GDP growth: 1.5% per year, with widening income distribution

Fast-growing sectors: private healthcare/education/social services; informal economic activity related to maintenance; defence; parts of manufacturing industry

Declining sectors: specialised products and services (for example, media) operating in global markets; banking and finance; some vulnerable sectors protected and subsidised

Key technologies: the rate of innovation is generally low, due to low investment in RTD. There is rapid uptake of technologies suited to smaller-scale economic production in commodity sectors (chemicals, paper, steel), including technologies enabling reuse and recycling

Settlement and Population: a stable population with comparatively little migration. Increasing household numbers are accommodated through brownfield developments

Environmental issues and priorities: aspirations to deal with local issues such as clean air and built environment but different regional priorities limit their success. Climate management fails in this scenario but, at the global level, greenhouse gas emissions grow relatively slowly while UK emissions stabilise

ECONOMIC ACTIVITY

The pursuit of narrow national interests makes this a relatively low growth world. GWP grows at 4 per cent per year while UK GDP grows sluggishly at 1.5 per cent per year. Economic growth is constrained due to capital and periodic resource shortages. Economic policy is concerned with protecting and supporting 'national champions' against foreign competition through various non-tariff and tariff barriers. This leads to managed agglomeration and the establishment of national monopolies in key sectors (pharmaceuticals, defence, electronics and the media). The control of electronic commerce is especially stringent.

The UK economy remains dependent on imports for certain key technologies and resources. External economic and political factors can have a major influence on the cost and access to these inputs. There is a general stabilisation in manufacturing, with growth in some areas where local production substitutes for goods previously imported. Personal services grow, especially for the new rich, while services for medium and low income brackets decline sharply. The informal economy flourishes as people try to shore up deteriorating infrastructures.



POPULATION AND SETTLEMENT

The UK population grows at a rate similar to that in the 'world markets' scenario, though inward migration is lower. Household formation continues to grow, but at lower rates, partly due to the relatively high cost of housing and limited social provision. Resistance to the development of new towns and communities is strong where it impinges on privately owned land. High population density in urban areas, coupled with a deteriorating and ageing housing stock, leads to increases in health problems, especially for poorer members of society. There is a rise in time spent at work and a decline in leisure. For all of these reasons, longevity declines. People are also more rooted in their own communities and travel less.

SECTORAL/TECHNOLOGY DEVELOPMENTS

Energy

Fossil fuels are in plentiful supply in this scenario, and renewables do not develop. There is a strong tendency to preserve existing sources of energy including indigenous coal and nuclear power by extending the lives of existing stations. The pursuit of energy efficiency is limited in this scenario despite the higher cost of generation, due to a lack of available capital and the low priority attached to environmental investments in the light of low levels of public concern.

Transport

This is a car-dependent scenario, with little additional provision for public transport. Congestion and accidents increase, because of public finance restrictions and NIMBY objections to new roads. With low investment, the average age of the car stock remains static and new technologies are restricted to the very top end of the car market. With the global economy growing more slowly, air traffic continues to grow but at a much lower rate than in the 'world markets' scenario. Freight transport moves predominantly by road, as developments in the rail system do not take place. Investments in new infrastructure are very low.

Construction

The construction sector struggles because of lack of investment in housing and infrastructure. Maintenance and conversion of existing buildings and infrastructures is the primary activity. Traditional UK construction techniques continue to play a major role. Much of the sector remains labour intensive and inefficient, with little conformance to building or other regulations.

Agriculture and Food

Food prices remain relatively low and a modified Common Agricultural Policy is continued. Current agricultural practices intensify and require high inputs of pesticides and fertilisers; the uptake of genetically modified organisms is patchy. There is less development of global markets for seasonal and high-quality food inputs. Retailers have a strong influence over farmers, manifested in requirements for uniform, high quality products rather than sustainable farming practices. The traditional British diet does not change radically.



Manufacturing

Capital scarcity and the preservation of national monopolies in key sectors means this is a low innovation, low investment, low wage scenario. There are only slow changes in industrial structure because traditional industries are protected from international competition. The pace of technological change is low but IT and biotechnology are still the main drivers of change. The most innovative players are SMEs producing goods and services for the national market. Environmental investments tend to be for remediation technologies. Pre-emptive approaches to environmental innovation are rare. 'Service based' relationships between consumers and manufacturers fail to develop.

THE STATE OF THE ENVIRONMENT

A low value is attached to the preservation of natural assets. There are concerns about local amenity and landscape quality, especially on the part of the better off. NIMBY protests are generally ineffective because planning and regulatory regimes are weak. Ironically, capital shortages and low economic growth mean that there are relatively few pressures on the environment from new housing or large-scale infrastructure projects - but existing plants suffering from under-investment create considerable problems.

Air quality: Declines as a result of low investment in emissions control and weak regulation.

Noise: Overall deterioration due to increased traffic levels and leisure activities, except in wealthier areas where access is controlled.

Water resources: Stable, but deteriorating in south and east. Quality deteriorates.

Biodiversity: Deterioration due to intensive agriculture and weak planning controls.

Landscape: Uncertain, probably deterioration.

Materials and resources use: Protection leads to higher extraction of UK energy and mineral resources; low investment in eco-efficiency and waste management.

Climate: The international climate regime fails and the UK becomes increasingly vulnerable to climate change.

SCENARIO 3: GLOBAL SUSTAINABILITY

BASIS

This scenario assumes communitarian, long-term, conservationist values and the globalisation of governance systems. Stress is placed on balancing economic, social and ecological values resulting in the adoption of more sustainable technologies and patterns of behaviour. Governance structures become more global but also more distributed. There is greater co-operation and management within the international system and the role of national governments is primarily in the negotiation and enforcement of global economic, social and environmental agreements. The scope for exercising national discretion becomes more limited as the need for fair treatment between different groups across the globe increases. Negotiating consensual agreements is time-consuming because of the need to achieve a more equitable distribution of economic and environmental resources between rich and poor countries, and within countries.

Consensus about sustainable development is transmitted through participative, open, democracies worldwide. There is a growing role for local governments within more federal political systems. Access to education is widespread and helps to underpin support for sustainable development strategies, including their social and equity dimensions. High-tech health promotion and preventive care replace, to some extent, care for the sick in health care systems. There is strong technical growth with technological innovation oriented towards clean, low input, production and consumption. There is greater sharing of resources within strong trading regimes which explicitly take account of social and environmental objectives. Growth is a little slower than in the 'World Markets' scenario but closer public and private sector attention is paid to alternative measures such as the ISEW.

**'GLOBAL SUSTAINABILITY': KEY INDICATORS**

Values: emphasis on the long-term and meeting collective wants and needs

Governance: globalisation of governance systems

UK GDP growth: 2 percent per annum long-term, increased attention to alternative measures such as ISEW

Fast-growing sectors: renewable energy and hydrogen-based power systems; nuclear power; integrated household service providers (heat, water, washing and refrigeration services); information and communication technologies (ICTs)

Declining sectors: fossil fuel-based power systems; resource-intensive agriculture and manufacturing

Key technologies: low input, low emission, production and consumption; ICTs substituting for travel

Settlement and Population: population stable; intensified redevelopment of towns and cities (new infrastructures to encourage low input economy and new energy efficient housing stock); strong planning controls preventing development in green areas

Environmental issues and priorities: Integrated approaches to all aspects of sustainable development at a local, national and global level. Greater weight placed on regional and global commons, and on the rights of future generations. 'Strong' sustainability principles applied to the private and public sectors' decisions

ECONOMIC ACTIVITY

Economic growth proceeds at a fairly high but sustainable level in this scenario. GWP grows at 4.5 per cent per year, slightly less slowly than in the 'world markets' scenario. UK GDP grows at 2 per cent per year. Global trade grows, but international trade and environment policies are co-ordinated to support international equity and sustainable development.

There is increased environmental efficiency combined with increased consumption. Highest growth is experienced in sectors providing eco-efficient goods and services. The 'greening' of business is pervasive, with adoption of 'best available' technologies. Some of the greatest commercial opportunities arise in fast-growing developing countries experiencing 'catch-up'. There is increasing emphasis on the provision of services (mobility, shelter, nutrition, health) as opposed to goods. Interest rates are low, producing high levels of investment, especially in projects with longer-term benefits to the economy and society.

Working hours decline and there is more leisure. High mobility of labour, global markets for training and education, and global tourism are all engines of convergence between cultural and political systems.



POPULATION AND SETTLEMENT

UK population stabilises by 2020 as a result of declining birth rates. This has to be seen in the context of a world population which falls towards the lower end of the range of UN projections because of increased wealth and higher standards of education. There is a great deal of temporary migration as a result of high international mobility of skills and labour. Lifespans are extended due to improvements in medicine and preventive healthcare; greater provision of social services is required to support an ageing population. Household formation rate falls, due to more collectivist social values and controls on new housing development.

SECTORAL/TECHNOLOGY DEVELOPMENTS

Energy

Natural gas is the dominant energy source up to 2010 but renewable energy sources gain a large market share thereafter. Emission-free fossil fuel options, and the use of large-scale carbon sequestration begin to play a major role in the UK energy mix in 2010-2020. A large global market for solar energy builds up by 2020-2025; there is major infrastructure investment to support the use of hydrogen, which is used significantly by 2030. The need to reduce carbon emissions coupled with a willingness to invest in technologies with low rates of return on capital, allow a partial revival of nuclear power from 2015. Encouraged by regulatory incentives, energy suppliers move towards the provision of integrated services, greatly enhancing the take-up of energy efficiency measures. The price of energy for the final consumer is high.

Transport

Major changes take place in developing integrated transportation systems which begin to address the twin goals of providing high quality access and low environmental impact. Road traffic growth continues but at a much slower rate than in the past. Technology plays a major role in reducing environmental impacts, with rapid market penetration by hybrid and fuel cell passenger vehicles, and heavy investment in public and mass transit systems. These changes are accompanied by rapid developments in the use of infomatics for overcoming congestion in both public and private transport systems. Freight transport shifts towards rail and water, with lower growth in road and air freight. From 2010, telematics begin to substitute for mobility. Air traffic continues to grow rapidly in this globalised world.

Construction

The built environment is transformed with investment in the rapid replacement of old and inefficient buildings and infrastructures. Due to strict development controls, housing construction is concentrated in existing urban centres and in brownfield sites. There is significant innovation in advanced land reclamation techniques. New, energy efficient, buildings are engineered products with relatively short lives. Much new infrastructure is sited underground and built using innovative engineering techniques and capital equipment. There is a particular emphasis on training and the acquisition of skills, as UK firms seek to learn advanced construction techniques.



Agriculture and Food

Under the 'global sustainability' scenario, there is an attempt to balance high agricultural yields with low environmental impacts. Retailers transmit consumer concerns to farmers via their purchasing policies. There is a gradual, controversial, uptake of genetically modified crops which takes place with tight regulatory controls in place to screen for adverse environmental and biodiversity impacts. Large-scale livestock farming declines as more people switch to vegetarianism and meat consumption declines more widely. Under a reformed Common Agricultural Policy, support payments for farmers are tied to the sustainable management of rural landscapes. Substantial areas of land are taken out of production and tend to be used to support nature conservation rather than recreation.

Manufacturing

Manufacturing industry is transformed by the combination of high investment and the drive towards a low input, 'small footprint', economy. Innovation is concentrated on radical improvements in eco-efficiency across the board, leading, for instance, to the adoption of low temperature-low pressure processes in the chemical industry. This has major implications for the market structure of many industries, with returns to scale being replaced by returns to scope and specialisation. By 2040 most producers change their business focus from products (cars or fridges) to providing high quality services.

THE STATE OF THE ENVIRONMENT

Working towards sustainable development is a high priority in this scenario. Environmental concerns are ideological as much as practical and immediate. Larger ideas such as the maintenance of biodiversity, the protection of the 'global commons' (the atmosphere, the oceans, wilderness areas) and resource efficiency drive environmental policy. Structural shifts, the growth of services, and rapid technological advances in IT and biotechnology promote dematerialisation. The pursuit of global objectives sometimes creates conflicts between global and local concerns.

Air quality: Rapid technological change in transport and energy sectors leads to significant improvements in air quality.

Noise: Noise problems persist, particularly those associated with construction, leisure activities and air transport.

Water: Resources are stable and quality is improved.

Biodiversity: Stable, or slight improvement.

Landscape: Strong protection of key habitats, but also growing demand for access to the countryside, and for leisure and tourism in clean quiet environments.

Materials and resources use: General reduction in intensity of aggregate resource consumption.

Climate: Strong international climate regime: global carbon trading system together with energy taxes.



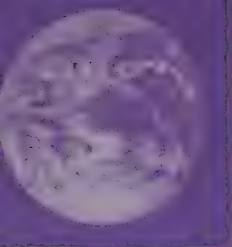
SCENARIO 4: LOCAL STEWARDSHIP

BASIS

This scenario assumes communitarian and conservationist values and the reinforcement of diverse political and economic systems through the development of regionalisation. Social values encourage cooperative self-reliance and the conservation of resources. Within a long-term perspective there is a strong emphasis on environmental issues and, to an even greater extent, equity and social inclusion. Political systems are transparent, participatory, inclusive and democratic at a more local level. These are reinforced by a high level of public provision for health, education and social services. Regional and local cultural identities are revived, and the family is strengthened as the primary social unit in the context of the local community. The flow of culture, people, capital, goods and services across economic and political boundaries is constrained.

Decision-making power is devolved downwards in a more federal system of government in the UK. Purposive social and economic planning is the norm, but political and business cultures tend to be corporatist and inward-looking. Traditional 'regulation' is replaced by a more diffused structure of governance involving stakeholders throughout society. International economic and political institutions are seen as ineffective in a culturally and politically diverse world, and exist primarily to mediate relations between countries.

Conventional economic growth is even slower than it is in the 'provincial enterprise' scenario but considerable improvements in environmental quality and social equality result in the ISEW index growing at 1 per cent per year.



'LOCAL STEWARDSHIP': KEY INDICATORS

Values: emphasis on the long-term and meeting collective wants and needs

Governance: discrete federal political systems; sovereignty is retained at regional and national levels; participatory, inclusive and democratic at a more local level

UK GDP growth: 1 percent long-run GDP growth, increased equity

Fast-growing sectors: small-scale manufacturing, locally-based financial and other services

Declining sectors: retailing, leisure and tourism

Key technologies: renewable energy (wind, biomass, photovoltaics)

Settlement and Population: decline of large metropolises, growth of small and medium-sized towns, mixed development, protection of the countryside

Environmental issues and priorities: strong grass-roots democracy results in improved local environmental management (noise, landscape and biodiversity), but reliance on local resources and weak international agreements limit success in addressing trans-boundary and global problems eg., acid rain and global warming; in some areas local environmental quality worsens

ECONOMIC ACTIVITY

This is a low growth scenario in which the structure of economic activities is determined by local conditions and specialisms. International trade plays a relatively less important role in economic growth, and national champions re-emerge in key industries. Government attempts to co-ordinate the economy to meet local demand through high quality, sustainable, provision of goods and services. GWP grows at 3 per cent per year, while UK GDP growth is only 1 per cent. Investment levels are relatively low, as a result of low economic growth and low rates of innovation. Smaller-scale production of goods and services is encouraged and SMEs, co-operatives and mutual societies prosper.

Technological outcomes are determined by regional resources and the capabilities of local industry, while considerable investments are made in a publicly-funded science and engineering base. Great emphasis is placed on preserving national economic, social and political security, with dependence on local resources and capabilities. Economic independence, where it is achievable, is usually the preferred option even when the relative costs are high. Where independence is not economically viable, regions and nation-states collaborate in co-operatively managed multinational ventures.

POPULATION AND SETTLEMENT

Beyond 2020, the UK population begins to decline slowly due to a continued fall in birth rates and lower levels of migration. The trend towards smaller households is reversed as a result of lower rates of family breakdown and an increasing number of extended family units. There is general migration away from the larger cities and a corresponding growth of small and medium-sized towns. Tight planning control over



the countryside, and the need to preserve land for agricultural production, lead to urban development which is dense, multifunctional and includes alternative transport and utilities infrastructures such as walking, cycling, urban farming and composting of wastes.

SECTORAL/TECHNOLOGY DEVELOPMENTS

Energy

The exploitation of local energy resources, whether fossil or non-fossil fuel, is a particular feature of this scenario. A wide range of renewable energy technologies, including wind, biomass, photovoltaics and small-scale hydro are exploited. However, returns to scale are more limited than in the 'global sustainability' scenario because a more diverse set of options is pursued. Locally based combined heat and power schemes flourish. Green tariffs are taken up by environmentally conscious consumers and reinforce more formal regulatory controls. High energy prices will lead to adoption of energy efficiency measures and, in some areas, small-scale nuclear power develops, partly as a route to energy independence. This is the only scenario in which energy demand falls, as well as becoming less carbon intensive.

Transport

There is emphasis on avoiding the need to travel, and on walking and cycling, with the planning system used to ensure that facilities are available close to people's homes. By 2010, co-operative car-sharing, home deliveries and traffic management schemes begin to reduce absolute car ownership. By 2025, cars based on alternative technologies (fuel cells, electricity, hybrids) are the norm for shorter journeys. Longer journeys tend to be made by mass transit systems (rail, bus and by air) many of which are publicly owned or managed. International freight movements level off as trade in goods stagnates. Tourism and leisure activities tend to be undertaken closer to home.

Construction

A conservationist ethic and low levels of investment lead to the survival of traditional housing. Social stability also means that demand for new housing is lower. There is increased investment in energy/water efficiency measures which can be locally based, like CHP and dry, vacuum-powered, local sewage systems. The construction industry continues to be dominated by small firms but the skill base is greatly enhanced, leading to efficiency gains and higher quality.

Agriculture and Food

The main goal of agricultural policy is to support a broader social yearning for local self-sufficiency and what are seen to be traditional farming practices. The major retailers lose market share to other supply routes, including farmers' markets and local shopping, while sales of exotic fruits and out-of-season vegetables decline. Agriculture is heavily subsidised, to protect both food security and local landscapes. Research and technical support enable farmers to adopt approaches which reduce pesticide inputs radically and there is a rapid growth in organic farming. Demand for meat continues to fall and broader support for animal rights brings an end to the transport of live animals over long distances.



Manufacturing

There are generally lower rates of investment and innovation in manufacturing industry. Major changes occur in industrial structure since the scale of markets is restricted, SMEs and technologies adapted to small-scale sustainable production being favoured. Innovative new applications of IT and biotechnology enable smaller production units to remain economic. There is a stress on eco-efficiency, quality and durability in consumer goods and there are longer term 'service' relationships between producers and consumers with locally-based maintenance and recycling systems.

THE STATE OF THE ENVIRONMENT

Sustainable development is a basic aim of this scenario, including the managed use of local resources, improvement of the environment, and the pursuit of social goals of equity and access. Social values and political processes encourage all individuals and groups in society to participate in achieving challenging sustainability targets. However, the capacity of different regions to meet environmental goals varies and there will be wide differences in environmental states. Global and regional environmental problems receive less attention, and are managed piecemeal.

Air quality: Mixed. Increased reliance on coal leads to persistence of problems associated with long-range transport of acid emissions; local air quality improves as a result of declining traffic.

Noise: Declining traffic levels result in reduced noise.

Water resources: Low growth in demand and increased efficiency measures result in stable or slight improvement in water resources, but with regional differences.

Water quality: Quality generally improves.

Biodiversity: Improves with shift away from high input agriculture.

Landscape: Improves through lower demand for agricultural land and emphasis on establishment of wilderness areas; landscape generally accessible to all.

Materials and resources use: Mixed, depending on resource endowments of region; high priority on eco-efficiency and recycling in resource-poor regions.

Climate: Weak international climate regime.

The material in this pack is taken from the Environmental Futures Scoping Study, written for the Foresight Natural Resources and Environment Panel by Frans Berkhout, Malcolm Eames and Jim Skea at SPRU - Science and Technology Policy Research at Sussex University; Dr Eric Audesley at Silsoe Research Institute; and Professor Chris Nash at the Institute of Transport Studies, University of Leeds.

There were a number of stages in the production of the future scenarios, which began with a review of existing literature and scenarios studies. The draft scenarios were then presented to a review panel which included members from WS Atkins Environment, ARCO Chemical Europe Inc., Severn Trent plc, Eastern Group plc, BP Exploration, Shell Research Ltd, Environment Agency, and CSERGE. The draft final scenarios were circulated to a wider audience to provide a check on the consistence, likelihood and relevance of the scenarios.

The authors' full report is available on the internet, at <http://www.foresight.gov.uk/> or available by request from the Office of Science & Technology.



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